

**REMARKS/ARGUMENTS**

Claims 1 through 8 are pending in this application and have been examined. Claims 1, 3 and 5 were rejected under 35 U.S.C. 102(e) over U.S. Patent No. 6,273,358 (“Mitsubishi”). Claims 2, 4, and 6 were rejected under 35 U.S.C. 103(a) over Mitsubishi in view of U.S. Patent No. 5,384,583 (“Katerberg”). Claims 7 and 8 were rejected under 35 U.S.C. 103(a) over U.S. Patent No. 6,334,668 (“Isamoto”) in light of Katerberg.

The Applicant has amended claims 1 through 8 to correct errors in English grammar and usage, as well as to more explicitly set forth certain limitations that were present in the claims prior to their amendment. The Applicant’s amendments have not narrowed the scope of the claims. In fact, in some instances, the claim scope is now broader. Exhibit A, captioned “Version with markings to show changes made,” attached hereto, shows the changes made to the claims.

In light of the amendments and the Applicant’s arguments as set forth herein, reconsideration of the present application is respectfully requested.

**Paragraph 1 of the Office Action: Objection to Claim 7**

In paragraph 1 of the Office Action, claim 7 was objected to because of certain specified informalities. The Applicant has amended claim 7 to correct those informalities, and accordingly requests that the objection be withdrawn.

**Paragraph 2 of the Office Action: Rejection of Claims 1, 3 and 5**

In paragraph 2 of the Office Action, claims 1, 3, and 5 were rejected as being anticipated by Mitsubishi. The Applicant respectfully traverses and requests reconsideration of this rejection.

Among the limitations of claims 1 and 3 that are neither disclosed nor suggested by Mitsubishi is the requirement of “a feedback loop feeding a terminal voltage applied to said piezoelectric actuators back to a second input of said power amplifier.” Similarly, claim 5

includes the limitation of “feeding said amplified drive waveform signal supplied to said piezoelectric actuators back to a second input of said piezoelectric actuators.”

While the Office Action asserts that Mitsuhashi discloses this limitation, Applicant respectfully disagrees. In Mitsuhashi, the voltage that is applied to the terminals of the piezoelectric actuators 10 – called voltage “PV” – is not fed back to operational amplifier 51. Rather, it is the common driving voltage signal output by current amplifier 52 – called voltage “PC” – that is fed back to the operational amplifier 51. Voltage PV and voltage PC are not the same, mainly due to the electric resistance of the line connecting the driving waveform generating circuit 60 – which generates PC – to the piezoelectric actuators 10 in the ink jet head. See Specification at 8, lines 20 through 21. That is to say, while Mitsuhashi shows the common driving voltage being fed back to the operational amplifier, it fails to disclose or suggest what is required by claims 1, 3 and 5: that the voltage supplied to the piezoelectric actuators be fed back to the operational amplifier. Thus the rejection of claims 1, 3 and 5 should be withdrawn.

**Paragraph 3 of the Office Action: Rejection of Claims 2, 4 and 6**

In paragraph 3 of the Office Action, claims 2, 4 and 6 were rejected as being unpatentable over Mitsuhashi in view of Katerberg. Applicant respectfully traverses and requests reconsideration of this rejection.

Claims 2 and 4 depend from – i.e., include all of the limitations of – claims 1 and 3 respectively. As was previously discussed, claims 1 and 3 each requires “a feedback loop feeding a terminal voltage applied to said piezoelectric actuators back to a second input of said power amplifier” – a limitation that Mitsuhashi fails to disclose or suggest.

Mitsuhashi also fails to disclose or suggest all of the limitations of claim 6 which, among its limitations, requires “inputting said amplified drive waveform signal supplied to said piezoelectric actuators, and inputting said output signal of said power amplifier to a second input of said power amplifier.” Claim 6 is substantially the method corresponding

to claim 3, discussed above. As was discussed with respect to claim 3, the voltage applied to the terminals of the piezoelectric actuators in Mitsuhashi is not fed back to operational amplifier 51. Rather, only the common driving voltage signal output by the current amplifier is fed back to operational amplifier 51.

The Office Action has combined the teachings of Mitsuhashi with those of Katerberg. Katerberg fails to cure the deficiencies of Mitsuhashi with respect to any claims of the present application. In Katerberg, the voltage applied to the driving piezoelectric elements 18 is not fed back to a power amplifiers, as claims 2, 4 and 6 each require. Rather, a feedback loop feeds the voltage signals output by piezoelectric elements 12 and 22 back to voltage follower amplifiers 28. This is in contrast to claims 2, 4, and 6, each of which requires a feedback loop that feeds the voltage applied to the piezoelectric elements back to a power amplifier. Moreover, voltage follower amplifiers 28 in Katerberg are not power amplifiers. Rather, they form part of Katerberg's differential buffer amplifier 16, which is also not a power amplifier, but merely extracts the vibration amplitude of a drop generator 10.

Thus, even the combination of Mitsuhashi and Katerberg fails to disclose or suggest each and every element of claims 2, 4 and 6. Withdrawal of the rejection of these claims is respectfully requested.

**Paragraph 4 of the Office Action: Rejection of Claims 7 and 8**

Finally, in paragraph 4 of the Office Action, claims 7 and 8 were rejected as being unpatentable over Isamoto in view of Katerberg. Applicant respectfully traverses and requests reconsideration of this rejection.

Among the limitations of claim 7 is the requirement of a negative feedback loop including a resistor and a capacitor, said negative feedback loop provided between said power amplifier included in said control circuit board and inputs of said transfer gates included in said intermediate circuit board. Claim 8, which depends from and includes all

the limitations of claim 7, also requires this feedback loop.

The Office Action admits that Isamoto fails to disclose the negative feedback loop provided between the transfer gates on the intermediate circuit board and the power amplifier on the control circuit board as required by each of claims 7 and 8. The Office Action asserts, however, that Katerberg cures Isamoto's deficiency in this regard. The Applicant respectfully disagrees.

As the Applicant has previously pointed out with respect to claims 2, 4 and 6, the only feedback loop disclosed in Katerberg feeds the voltage signals output by piezoelectric elements 12 and 22 back to voltage follower amplifiers 28. Katerberg does not show a feedback loop provided between a transfer gate and a power amplifier. In fact, Katerberg does not show a transfer gate at all. In Katerberg, the driving voltage is applied directly to driving piezoelectric elements 18. Moreover, even if one were to assume that the voltage applied to the input of a driving piezoelectric elements 18 would be same as a voltage applied directly to the input of a transfer gate, Katerberg still fails to show a feedback loop provided between the input to the driving piezoelectric elements 18 and a power amplifier as required by claims 7 and 8.

Conclusion

For the reasons stated above, the Applicant submits that each of pending claims 1 through 8 of the present application is in immediate condition for allowance, and the Applicant respectfully asks that the Examiner withdraw the outstanding claim rejections and allow this application to be passed to issue.

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Respectfully submitted,

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**Version With Markings to Show Changes Made****In the Claims:**

1. (Amended) A drive circuit [of] for an ink jet head having nozzles, pressure generating chambers filled with ink to be [jetted] discharged from said nozzles, and [piezo-electric] piezoelectric actuators [provided correspondingly] corresponding to respective [said] pressure generating chambers, [for jetting] said ink jet head discharging ink droplets from said nozzles by changing volumes of said pressure generating chambers [by applying] in response to a drive waveform signal applied to said [piezo-electric] piezoelectric actuators, said drive circuit comprising:

a waveform generator [for] generating [the] said drive waveform signal;

a power amplifier [for] amplifying [the] said drive waveform signal supplied to [one] a first input of said power amplifier and outputting [it] said drive waveform signal to said [piezo-electric] piezoelectric actuators; and

a feedback loop [for] feeding [back] a terminal voltage [of] applied to said [piezo-electric] piezoelectric actuators back to [the other] a second input of said power amplifier.

2. (Amended) [A] The drive circuit of [an ink jet head, as claimed in] claim 1, wherein said feedback loop [for feeding back the terminal voltage of said piezo-electric actuators] includes a capacitor [for leading to ]producing a lead to phase signal [phase] in a high frequency range.

3. (Amended) A drive circuit [of] for an ink jet head having nozzles, pressure generating chambers filled with ink to be [jetted] discharged from said nozzles, and [piezo-electric] piezoelectric actuators [provided correspondingly] corresponding to respective [said] pressure generating chambers, [for jetting] said ink jet head discharging ink droplets from said nozzles by changing volumes of said pressure generating chambers [by applying] in response to a drive waveform signal applied to said [piezo-electric] piezoelectric actuators, said drive circuit comprising:

a waveform generator [for] generating [the] said drive waveform signal;

a power amplifier [for] amplifying [the] said drive waveform signal supplied to [one] a first input of said power amplifier and outputting [it] said drive waveform signal to said [piezo-electric] piezoelectric actuators; and

a feedback loop [for] feeding back a terminal voltage of said [piezo-electric] piezoelectric actuators and [the] said output signal of said power amplifier to [the other] a second input of said power amplifier.

4. (Amended) [A] The drive circuit of [an ink jet head, as claimed in] claim 3, wherein said feedback loop [for feeding back the terminal voltage of said piezo-electric actuators] includes a capacitor [for leading to ]producing a lead to phase signal [phase] in a high frequency range.

5. (Amended) A [drive] method of [an ]driving an ink jet head, said ink jet head having nozzles, pressure generating chambers filled with ink to be [jetted] discharged from said nozzles, and [piezo-electric] piezoelectric actuators [provided correspondingly] corresponding to respective [said] pressure generating chambers, [for jetting] said ink jet head discharging ink droplets from said nozzles by changing volumes of said pressure generating chambers [by applying] in response to a drive waveform signal applied to said [piezo-electric] piezoelectric actuators, said method comprising the steps of:

generating [the] said drive waveform signal;

inputting [the] said drive waveform signal to [one] a first input of a power amplifier [and supplying] to produce an amplified [signal of the] drive waveform signal, and supplying said amplified drive waveform signal to said [piezo-electric] piezoelectric actuators; and

feeding [back the] said amplified drive waveform signal supplied to said [piezo-electric] piezoelectric actuators back to [the other] a second input of said [piezo-electric] piezoelectric actuators.

6. (Amended) A [drive] method of [an ]driving an ink jet head, said ink jet head having nozzles, pressure generating chambers filled with ink to be [jetted] discharged from

said nozzles, and [piezo-electric] piezoelectric actuators [provided correspondingly] corresponding to respective [said] pressure generating chambers, [for jetting] wherein said ink jet head discharges ink droplets from said nozzles by changing volumes of said pressure generating chambers [by applying] in response to a drive waveform signal applied to said [piezo-electric] piezoelectric actuators, said method comprising the steps of:

generating [the] said drive waveform signal;

inputting [the] said drive waveform signal to [one] a first input of a power amplifier [and supplying] to produce an amplified [signal of the] drive waveform signal, and supplying said amplified drive waveform signal to said [piezo-electric] piezoelectric actuators; and

inputting [the] said amplified drive waveform signal supplied to said [piezo-electric] piezoelectric actuators, and [the] inputting said output signal of said power amplifier to [the other] a second input of said power amplifier.

7. (Amended) A drive circuit [of] for an ink jet head of a serial type ink jet printer, [which includes] the ink jet head including a carriage [mounting], nozzles, and [pressure generating chambers and in which ink droplets are jetted from the nozzles by sharply changing volumes of said] pressure generating chambers filled with ink [by applying], wherein said ink jet head discharges ink droplets from the nozzles by changing volumes of said pressure generating chambers in response to a drive waveform signal applied to [piezo-electric] piezoelectric actuators [provided] corresponding to said [respective] pressure [generator] generating chambers while moving said carriage reciprocally in a direction perpendicular to a feeding direction of a printing sheet, said drive circuit comprising:

a control circuit board [mounting] including a waveform generator [for] generating a signal for driving said ink jet head, a power amplifier [for] amplifying the output signal of said waveform generator [to an electric power capable of driving said ink jet head], an image memory [for] storing printing data, and a data transmitter [for] transmitting [the] image data stored in said image memory as [a] serial data thereon;

an intermediate circuit board mounted on said carriage [and mounting], said intermediate circuit board including a data receiver [for] receiving [the] said serial data



from said data transmitter, transfer gates [for] selecting [piezo-electric] piezoelectric actuators on the basis of [the] said received printing data, and a level shifter [for] matching voltage levels [of] from said data receiver [and said] to respective transfer gates [thereon];

a cable [for] connecting said control circuit board and said intermediate circuit board to each other; and

a negative feedback loop including a resistor and a capacitor [and], said negative feedback loop provided between said power amplifier included in said control circuit board and inputs of said transfer gates [connected and] included in said intermediate [circuit board to said power amplifier mounted on said control] circuit board.

8. (Amended) [A drive circuit of an ink jet head, as claimed in claim 7, wherein said ink jet head drive circuit of said serial type ink jet printer further comprises] The drive circuit of claim 7, further comprising a negative feedback loop including a resistor [and], said negative feedback loop being provided between an output and an input of said power amplifier mounted on said control circuit board.